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(71) Applicant: **Alessi, Manfredo**
Via Borgazzi 134
Monza(IT)

Applicant: **Zerboni, Carlo Alberto**
Via R. Fucini 1
Milano(IT)

(72) Inventor: **Alessi, Manfredo**
Via Borgazzi 134
Monza(IT)
Inventor: **Zerboni, Carlo Alberto**
Via R. Fucini 1
Milano(IT)

(74) Representative: **Gervasi, Gemma, Dr.**
NOTARBARTOLO & GERVASI Srl 33, Viale Bianca Maria
I-21100 Milano(IT)

(54) **Structural glass walling with joints formed from structural sealants and metal structures.**

(57) Structural glass walling in which the individual facade glass plates comprise joints formed from structural sealants and from metal elements (5) which engage the facade glass plates (2)(3) in recesses (4) formed in their four side edges, to form a safety connection which mechanically supplements the chemical-physical connection formed by the structural sealants.

Said metal elements (5) are fixed to an internal metal support structure (7), and said joints are sealed with synthetic polymer material (16) in order to form a connection which is fixed but which enables the glass walling to slide relative to the structure under thermal expansion.

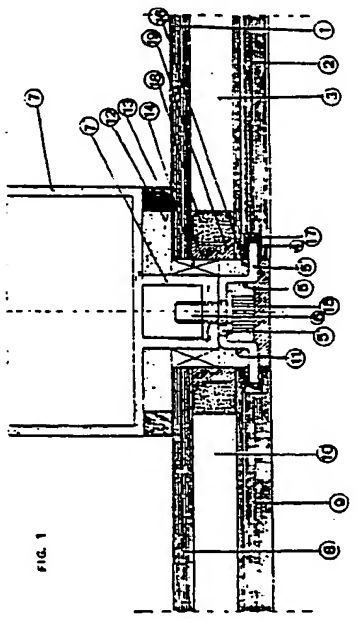

FIG. 1

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STRUCTURAL GLASS WALLING WITH JOINTS FORMED FROM STRUCTURAL SEALANTS AND METAL ELEMENTS

This invention relates to structural glass walling and to the method for its installation.

More particularly, the invention relates to structural glass walling in which the joint between the individual glass plates on the structural uprights is formed by structural sealants and supplemented by metal elements which are then surrounded by the sealant.

Structural glass walling of two basic types is known, namely the two-sided and four-sided types.

The two-sided structural glass walling is fitted with metal press clips which fix the individual glass plates at their top and bottom sides, whereas the other two sides are joined to the corresponding adjacent sides of the adjacent glass plates by structural sealants.

The said metal press clips create discontinuities in this glass walling, with the result that its appearance of continuity is interrupted horizontally at each joint, and in addition its maintenance and cleaning become difficult.

Four-sided glass walling is formed without any mechanical support for the facade glass plates, the joints of which are made simply by means of sealants.

Glass walling is thus obtained having the advantage of presenting a continuous surface, however justified doubts exist regarding the construction of buildings of considerable height by this method, due to the fact that the behaviour of these structures in the medium and long term is still not known, particularly with regard to the glass-sealant and sealant-aluminium joints.

The drawbacks of structural glass walling of the known art are obviated by the structural glass walling constructed in accordance with the present invention, which is of the four-sided type but, in contrast to that of the known art, has each facade glass plate anchored mechanically to the internal support structure. This glass walling has the advantage of forming a continuous outer surface while offering maximum guarantee of long-term mechanical strength.

The structural glass walling according to the present invention is characterised in that the individual facade glass plates comprise joints formed from structural sealants and from metal elements which engage said plates in recesses formed in their four side edges, said metal elements being fixed to an internal metal support structure.

Said structural glass walling is installed by forming the recesses in each of the four side edges of the facade glass plates, inserting into each recess one end of a metal joining element which is fixed in its turn to an internal metal support structure, then sealing the joint by means of synthetic polymer materials in order to form a connection which is fixed but enables the glass walling to slide relative to the structure by thermal expansion.

These and further characteristics and advantages of the structural glass walling and of the relative installation method according to the present invention will be more apparent from the detailed description given hereinafter with reference to the figures which show preferred embodiments of the invention by way of non-limiting example.

Figure 1 is a sectional plan view showing all the elements of a joint between two glass plates, Figures 2, 3 and 4 show those parts of the glass plates which participate in the joint, and Figures 5 and 6 show a metal joining element in its main views.

The joint of Figure 1 is applied to double glazed walling in which the two glass plates 2 and 1, ie the facade and inner glass plate respectively, define the air space 3 and the two glass plates 8 and 9 define the air space 10.

In the edge facing the adjacent glass plate 9, the glass plate 2 comprises the recess 4 into which the arm 5′ of the bracket 5 is inserted, the arm 5″ of said bracket being screwed by the screw 6 to the element 7′ of the structure 7.

Likewise the glass plate 9, which forms the continuation of the glass plate 2 in the facade, is fixed to the element 7′ by the bracket 11 which is equal to the bracket 5 but is applied in the opposite direction and offset in height in order to prevent the two screwed arms being superposed on the structure so as to reduce the extent of their outward projection and simultaneously ensure that the individual glass plates are independent in terms of their fixing and/or possible future removal, which may be required for maintenance or any other reason.

The section bar 7 and the inner glass plate 1 are spaced apart by a jointing bed generally of open-cell expanded polyethylene, they being connected together by an outer layer 13 of structural sealant.

The support block 14 is inserted into the vertical section between the end of the glass plate 1 and the element 7′.

In order to provide continuity to the outer facade of the glass wall, a layer 15 of waterproofing silicone is applied over an internal jointing bed filling 16 generally of open-cell expanded polyethylene.

A filling 17 of sealant material is provided in the cavity 4 to ensure fixing between the glass plate 2 and arm 5' of the bracket 5 while allowing the glass plate to expand thermally relative to the main structure, thus acting as an elastic joint. The glass plate 1 and glass plate 2 are kept spaced apart at the required distance by the spacer element 18 which contains within its interior dehydrating substances the purpose of which is to keep the gas within the enclosed space dry.

Finally the glass plates 1 and 2 are sealed to each other by the layer 19 of special sealing material used for double-glazed windows.

As can be clearly seen from Figure 1, elements equal to those described for the glass plates 1 and 2 are applied to the corresponding side of the glass plates 8 and 9.

Two or more joints equal to those described are applied to each side of each of the external glass plates of the structural glass walling, the number of such joints depending on the glass plate dimensions.

For example three joints can be applied to each side of square glass plates having a side of between 1.5 m and 1.8 m, they being distributed as shown in Figure 2 with their axes staggered on the side a with respect to the side b, and on the side c with respect to the side d, because on installation the side a has to abut against the corresponding side b and the side c has to abut against the corresponding side d in such a manner that the screwed arms of the brackets are not superposed, for the reasons already given in the description of Figure 1.

The recesses 4 provided in the side edges of the glass plates, as shown in the views of Figures 1, 3 and 4, are formed by milling followed by toughening of the glass to give the edges of the recess the necessary mechanical strength.

The depth and height of the recess depend on the glass plate thickness and the predicted operating loads for the structural walling facade. The minimum depth of the recess is 3 mm, and its width varies preferably from 3 to 5 mm as the layer thickness varies from 8 to 12 mm. Its depth obviously varies in consequence.

Alternatively, if using stratified glass, the cavity can be formed directly by choosing the dimensions of the individual component layers such that the intermediate layer has a smaller side than the outer layers.

In any event, the recesses can be either located at precise points on the sides of the glass plates or can extend along the entire sides.

The metal bracket 5 is shown in front and side view in Figures 5 and 6 respectively. In said figures, the reference numerals 5' and 5" indicate respectively the arm inserted into the recess 4 provided in the glass plate and the arm fixed by screw to the element 7' of the support section 7. The bracket 5 is constructed of stainless steel, preferably AISI 316, and its thickness, from 1 to 2 mm, depends on the thickness of the glass plate. It is apparent that other types of metal element can be used instead of the described bracket without leaving the scope of the invention. For example, a single metal strip can be used to form a direct joint between the glass plates 2 and 9 by engaging its ends in two corresponding recesses in the two glass plates, or by engaging pins fixed to its two ends in corresponding bores formed in the two glass plates. Said bracket or said other metal elements can be fixed to the internal structure by means other than screws, for example by riveting or welding. Again, said bracket or strip can be made rigid with the internal structure in a manner mobile relative to the structural frame in order to allow elements of the walling to be opened by the conventional opening systems of the compass, rotation, butterfly or top or bottom hung type, obviously in any required direction, either upwards, downwards or sideways, and inwards or outwards.

Claims

1. Structural glass walling characterised in that the individual facade glass plates comprise joints formed from structural sealants and from metal elements which engage said glass plates in recesses formed in their four side edges, said metal elements being fixed to an internal metal support structure.

2. Structural glass walling as claimed in claim 1, caracterised in that each of said metal elements comprises two arms, one of which is to be inserted into one of said recesses and the other of which is to be fixed to said internal metal support structure.

3. Structural glass walling as claimed in claim 1, characterised in that said metal elements are constructed of AISI 316 stainless steel sheet of from 1 to 2 mm thickness depending on the thickness of the glass plate to be fixed.

4. Structural glass walling as claimed in claim 1, characterised in that said metal elements are fixed to said internal metal support structure by screws, riveting, welding or another equivalent system.

5. Structural glass walling as claimed in claim 1, characterised in that said metal elements consist of a single metal strip which forms a direct joint between two adjacent glass plates by engaging its ends in two corresponding recesses of the two glass plates.

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6. Structural glass walling as claimed in claim 1, characterised in that said recesses are formed by milling into the side edges of said glass plates, followed by toughening.

7. Structural glass walling as claimed in claim 1, characterised in that, in the case of stratified glass, said recesses are formed by making the intermediate layer of smaller dimensions than the upper and lower layers so as to obtain an equivalent effect to that obtained by milling.

8. Structural glass walling as claimed in claim 1, characterised in that said recesses have a minimum depth of 3 mm.

9. Structural glass walling as claimed in claim 1, characterised in that said recesses have a height varying from 3 to 5 mm for glass plates having a thickness varying respectively from 8 to 12 mm.

10. Structural glass walling as claimed in claim 1, characterised in that two or more said recesses are provided for each side of said glass plates.

11. Structural glass walling as claimed in claim 1, characterised in that said sealing of the joint in correspondence with the external facade is done with waterproofing silicone.

12. Structural glass walling as claimed in claim 1, characterised in that said sealing in correspondence with the joint between the glass plate and internal metal support structure is done with a layer of structural sealant.

13. A method for installing structural glass walling claimed in claims 1 to 12, characterised by forming recesses in each of the four side edges of the facade glass plates, inserting into each recess one end of a metal joining element which is fixed in its turn to an internal metal support structure, then sealing the joint by means of synthetic polymer materials in order to form a connection which is fixed but enables the glass walling to slide relative to the structure by thermal expansion.

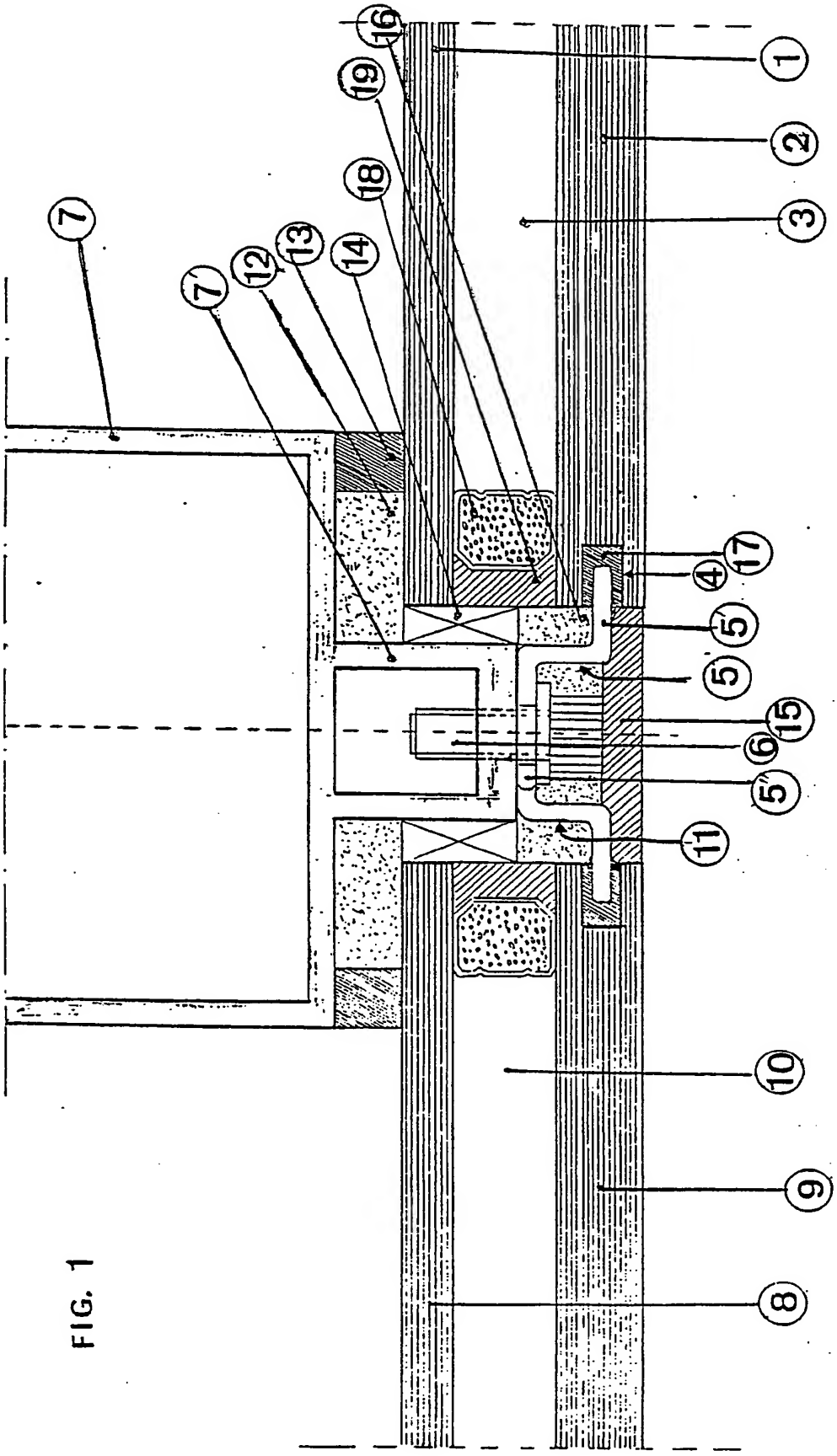

FIG. 1

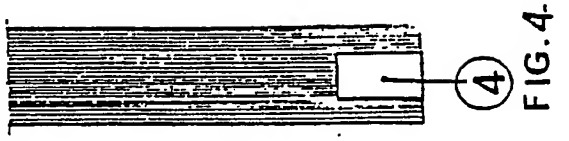

FIG. 4

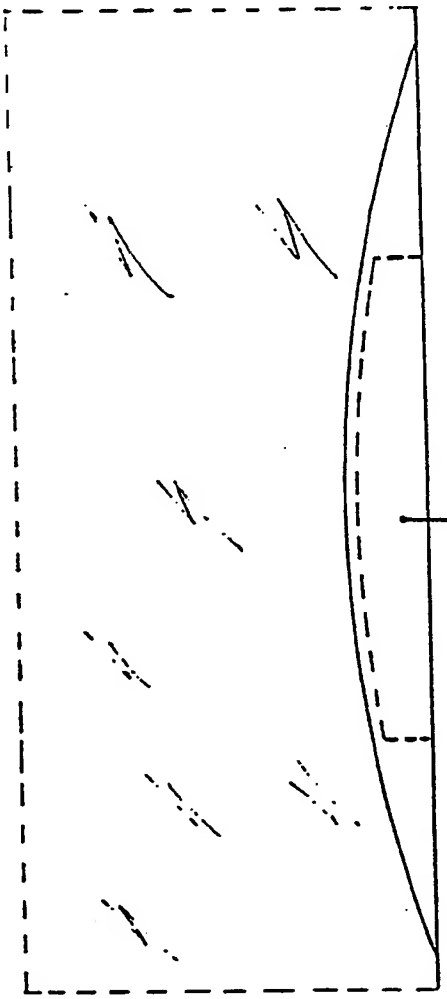

FIG. 3

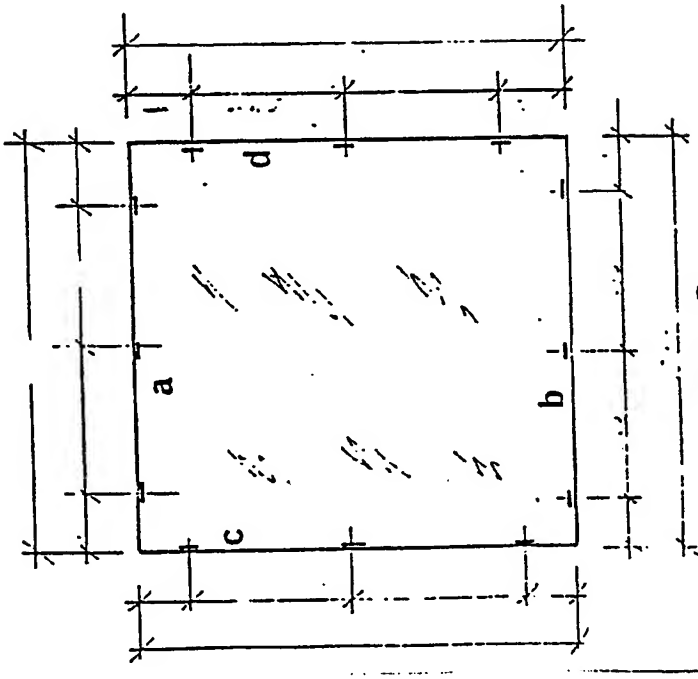

FIG. 2

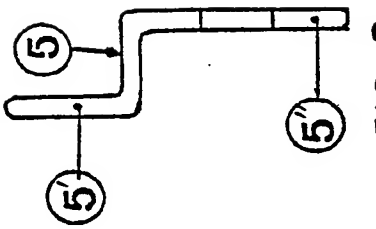

FIG. 6

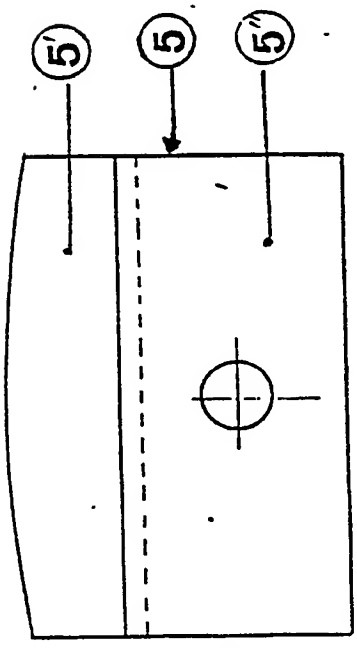

FIG. 5

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EUROPEAN SEARCH REPORT

Application number

EP 87 10 8509

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	EP-A-0 130 438 (VERNON) * Page 3, lines 12-21; page 3, line 30 - page 5, line 14; page 8, lines 20-22,27-30; page 9, line 32 - page 10, line 30; page 14, line 26 - page 17, line 5; page 17, line 33 - page 26, line 11; page 27, line 33 - page 29, line 15; drawings *	1,4,5, 7-13	E 04 B 2/96 E 06 B 3/54 E 06 B 3/68
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Y	GB-A-2 167 110 (SCHUCO) * Page 1, line 80 - page 2, line 7; drawing 1 *	1,4,7-12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A		5,13	E 04 B E 06 B

Y	FR-A-2 321 575 (BFG GLASSGROUP) * Page 5, lines 27-29; page 6, lines 24-37; page 9, lines 14-18; page 10, lines 4-35; drawings 4-7 *	1,4,5, 7-13	

A	DE-A-3 406 541 (KLENT) * Page 5, lines 11-34; drawings 1,2 *	1-4,11	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-09-1987	LAUE F.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application number

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	DE-U-8 508 113 (RÜTERBAU) * Page 8, lines 10-23; drawings * -----	1,4,6, 13	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

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